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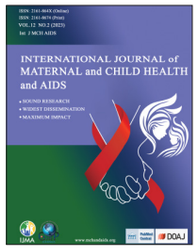

ORIGINAL ARTICLE *RESPIRATORY DISTRESS SYNDROME*

Management of Newborn Respiratory Distress Using CPAP: Capacity and Readiness of Public Health Facilities in High-Focus Aspirational Districts of India

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ABSTRACT

Background and Objective: Adequate respiratory support is crucial for managing respiratory distress in hypoxic newborns. Continuous positive airway pressure (CPAP) devices are widely recommended for this purpose, but their availability and functionality in district-level healthcare facilities in India are unclear. This study aims to assess the capacity and readiness of public health facilities in high-focus Aspirational Districts of India to manage respiratory distress using CPAP and oxygen support.

Methods: A cross-sectional descriptive study was conducted in 15 functional Special Newborn Care Units (SNCUs) across 14 Aspirational Districts in five Indian states. Data were collected using a semi-structured tool developed in collaboration with state health authorities, aligned to national and global newborn care guidelines. The study focused on assessing the status of infrastructure, human resources, oxygen supply, CPAP utilization, and staff practices.

Results: Pulse oximeters were available in all SNCUs, with most units using monitor-based devices. Oxygen supply was available at 89% of SNCU beds. Different sources of oxygen supply at SNCUs included oxygen concentrators (93%), manifold rooms (33%), and oxygen plants (13%). CPAP devices were available in only 20% of SNCUs. Oxygen concentrators emerged as the predominant method for oxygen therapy (66.7%), followed by central oxygen supply via manifold room or oxygen plant (26.7%). Monitoring of the oxygenation status of newborns on respiratory support was done at a frequency of at least every 3 hours in 66.7% of units.

Conclusion and Global Health Implications: The study identified significant gaps in the use of CPAP devices for managing hypoxic newborns in special newborn care units (SNCUs) of Aspirational Districts, reflecting broader healthcare challenges. There is an urgent need to improve oxygen delivery systems and increase CPAP availability in secondary health facilities. These findings call for targeted interventions, capacity building, and strategic resource allocation to enhance neonatal health outcomes in resource-limited settings.

Keywords: Aspirational Districts, Continuous Positive Airway Pressure, Neonatal Intensive Care, Neonatal Mortality, Oxygen Supply, Respiratory Distress Syndrome, Special Newborn Care Unit

INTRODUCTION

Background of the Study

The neonatal period is crucial for newborn survival, emphasizing the need for prioritized care to prevent life-threatening outcomes. Global estimates for 2022 revealed a staggering loss of nearly 2.3 million newborns, equating to about 6,500 deaths per day. This toll represents a significant 47% of all under-five-year deaths worldwide, with a skewed distribution towards low- and middle-income countries (LMIC).[1] Nearly 80% of neonatal deaths, particularly in the LMIC, are due to three leading causes: prematurity and low birth weight; perinatal complications such as intrauterine hypoxia and birth asphyxia; and infection.[2] Respiratory Distress Syndrome (RDS), the most common cause of neonatal mortality, has a reported case fatality rate of up to 20% in normal and around 45% in pre-term births in LMICs, particularly due to inadequate quality of care at birth and limited early neonatal interventions.[3, 4]

Effective respiratory support, essential for managing RDS among hypoxic newborns, involves two main clinical approaches: continuous positive airway pressure (CPAP) and mechanical ventilation.[3] CPAP is a cost-effective, simpler, and safer alternative.[4] The World Health Organization (WHO) recommends the use of CPAP for the treatment of preterm newborns with RDS. Notably, CPAP has demonstrated a remarkable 66% reduction in mortality among preterm neonates in LMICs.[5] The CPAP is widely used for managing respiratory distress in healthcare facilities and has been utilized in high-income countries for decades. However, its availability and functionality have remained limited in the LMICs.[5, 6]

The high burden of the newborn mortality rate (NMR) in India, with deaths of an estimated 0.4 million newborns in 2022, has been of public health concern.[7] RDS alone contributed to over one-third of newborn deaths in the country and ranks as the leading cause of NMR.[4, 8–11] There also exists a disparity in NMR within different states of India, with a higher contribution of NMR skewed towards vulnerable geographies.[12]

In 2011, the Ministry of Health and Family Welfare (MOHFW), Government of India (GOI), launched Facility-Based Newborn Care (FBNC) to provide essential newborn care as well as care of sick newborns at various levels of health facilities. This includes the establishment of Newborn Care Corners (NBCCs) in labor rooms in all facilities, Newborn Stabilization Units (NBSUs) at First Referral Units (FRUs), and Special Newborn Care Units (SNCUs) at district hospitals and tertiary care facilities. The SNCUs provide level II care to sick and preterm newborns and operate in district and sub-district hospitals with an annual delivery load exceeding 3,000.[13] These units are equipped to handle sick newborns other than those who need ventilatory support and surgical care.

National guidelines recommend the use of oxygen for managing RDS in newborns admitted to SNCUs. However, despite the WHO's endorsement, the recommendations for using CPAP have been missing in the country's guidelines. While certain states have procured CPAP devices mainly confined to SNCUs at selected districts and specialized hospitals, their availability, functionality, and utilization remain unclear. A 2020 study indicated that approximately one-third of government district hospitals (37%) and two-thirds of medical college hospitals (68%) with neonatal care units had integrated CPAP into their care protocols.[14] However, no studies have yet assessed the availability of CPAP and health system preparedness to manage RDS in public health settings within high-priority Aspirational Districts of India.

The term "Aspirational Districts" refers to 112 of India's most socioeconomically disadvantaged districts based on specified criteria, including socio-economic disparities, inadequate healthcare infrastructure, poor maternal, newborn, and child health (MNCH) outcomes, and limited access to essential medical interventions. These districts were selected by the GOI for targeted development under the Aspirational Districts Programme (ADP). Launched in 2018, the ADP aims to accelerate these districts' transformation through a convergence, collaboration, and competition model, fostering a mass movement for improvement. The selection of these districts is based on their ranking across 49 Key Performance Indicators (KPIs) developed by the National Institution for Transforming India (NITI) Aayog, the GOI's premier public policy think tank. These KPIs are grouped under five broad socio-economic themes: health & nutrition, education, agriculture & water resources, financial inclusion & skill development, and infrastructure.[15, 16]

The MoHFW, GOI, has nominated various partner agencies to support the rollout and implementation of the Aspirational District program across the states. The United States Aid for International Development (USAID) India has been identified as the partner agency to support 25 Aspirational Districts located in the states of Haryana, Himachal Pradesh, Jharkhand, Punjab, and Uttarakhand.

USAID, through its Systems Approach for MNCH focusing on Vulnerable Geographies (SAMVEG), a project implemented by international political economy (IPE) Global in partnership with the State Health Missions of Haryana, Himachal Pradesh, Jharkhand, Punjab, and Uttarakhand, conducted a comprehensive assessment at SNCUs in 14 selected Aspirational Districts of these five states.

Table 1: Aspirational districts with SNCUs included in situational analysis.

States	Aspirational districts			Number of SNCU included
	Total	With SNCU	Districts included	
Jharkhand	19	13	8 (Ranchi, Gumla, Bokaro, Giridih, Hazaribag, West Singhbhum, Dumka, and Godda)	9 (8 DH and 1 medical college)
Uttarakhand	2	2	2 (Haridwar and Udham Singh Nagar)	2 (DH)
Punjab	2	2	2 (Firozpur and Moga)	2 (DH)
Haryana	1	1	1 (Mewat)	1 (DH)
Himachal Pradesh	1	1	1 (Chamba)	1 (DH)
Total	25	19	14	15

SNCU: Special newborn care unit, DH: District hospitals.

Study Objectives and Specific Aims

The objectives of the study were to (1) determine the readiness of health facilities to manage respiratory distress among newborns in public health settings and (2) assess the availability and use of CPAP at SNCUs.

The study aimed to assess the status of supplemental oxygen and its delivery mechanisms in selected SNCUs, investigate the availability and use of CPAP, and examine staff practices for managing newborns with RDS.

METHODS

Study Design and Settings

The study employed a cross-sectional descriptive design to assess readiness to manage RDS among newborns at 15 functional SNCUs in Aspirational Districts of five states.

Out of 25 Aspirational Districts in five states, 19 districts had functional SNCUs in government district hospitals. The universal sampling method was utilized in four states (Haryana, Himachal Pradesh, Punjab, and Uttarakhand), and all 6 SNCUs in their Aspirational Districts were included. In Jharkhand, 8 out of 13 districts with SNCUs' were purposively selected in consultation with the authorities from the State Health Mission of Jharkhand. Of these 8 districts in Jharkhand, Ranchi also hosts an SNCU in the government medical college, which was also included for assessment. Concluding above, 15 functional SNCUs from 14 Aspirational Districts were included in the assessment. Details about Aspirational Districts with SNCUs and those selected for assessment are summarized in Table 1.

Data Collection

A semi-structured observational checklist and questionnaire were developed for the assessment in consultation with the State Health Mission authorities. The study tools adhered to the standard definitions and parameters outlined in the National "Facility-Based Newborn Care (FBNC) Guidelines for Small and Sick Newborns" and global recommendations.[13] To facilitate understanding of the overall health readiness, the tools comprised separate sections covering available human resources, SNCU infrastructure, oxygen supply system, and devices, use of CPAP, staff practices related to respiratory support and its monitoring, and follow-up of newborns discharged from these units. The tools were pilot-tested in two unsampled districts from Jharkhand and Uttarakhand for required revisions and finalization.

To ensure quality and consistency during data collection, a one-day training session was organized before data collection to orient the team members on the checklist and questionnaire as well as national guidelines on facility-based newborn care. A formal letter was issued from the health departments in respective states to the SNCU in charge to facilitate data collection. The data were collected by joint teams comprising state health department officials and SAMVEG project staff. All selected SNCUs were visited for assessment between October and December 2021, and relevant information was collected through on-site observations and in-person interviews with doctors and nursing staff. Informed consent was obtained from the staff members before conducting the interviews, and only those who expressed willingness to participate were included.

Study Variables

The key outcomes of interest included (1) the proportion of SNCUs in the Aspirational Districts equipped with the necessary equipment for diagnosing and managing RDS; (2) availability of oxygen supply with appropriate delivery mechanisms; and (3) utilization of CPAP and adherence to recommended practices for providing respiratory support to hypoxic newborns.

Table 2: Basic infrastructure and readiness for diagnosing neonatal respiratory distress at SNCUs in Aspirational District [Numerators in parenthesis].

Parameters	State wise findings					Total
	Jharkhand	Uttarakhand	Punjab	Haryana	Himachal Pradesh	
Number of SNCUs assessed (*N*)	9	2	2	1	1	15
Human resource and infrastructure						
SNCUs with an adequate number of medical officers	55.6% (5)	0.0% (0)	0.0% (0)	100.0% (1)	100.0% (1)	46.7% (7)
SNCUs with an adequate number of staff nurses	11.1% (1)	50.0% (1)	0.0% (0)	0.0% (0)	100.0% (1)	20.0% (3)
SNCUs with at least 12 pediatric beds (recommended)	100.0% (9)	50.0% (1)	0.0% (0)	100.0% (1)	100.0% (1)	80.0% (12)
SNCUs with emergency power backup	66.7% (6)	100% (2)	100% (2)	100% (1)	100% (2)	80.0% (12)
Readiness for diagnosing and managing RDS						
SNCUs with the availability of Pulse Oximeters	100.0% (9)	100.0% (2)	100.0% (2)	100.0% (1)	100.0% (1)	100.0% (15)
• Finger clip Pulse Oximeter	44.4% (4)	100.0% (2)	100.0% (2)	0.0% (0)	100.0% (1)	60.0% (9)
• Handheld multimodal device	0.0% (0)	50.0% (1)	50.0% (1)	0.0% (0)	0.0% (0)	13.3% (2)
• Monitor based fixed device (recommended)	77.8% (7)	50.0% (1)	50.0% (1)	100.0% (1)	100.0% (1)	73.3% (11)
SNCUs with X-ray facility of non-bedside	88.9% (8)	50.0% (1)	0.0% (0)	100.0% (1)	0.0% (0)	66.7% (10)
SNCUs with X-ray facility of bedside	11.1% (1)	50.0% (1)	0.0% (0)	100.0% (1)	0.0% (0)	20.0% (3)
SNCUs with the availability of CPAP	11.1% (1)	0.0% (0)	100.0% (2)	0.0% (0)	0.0% (0)	20.0% (3)
SNCUs with Caffeine	55.6% (5)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	33.3% (5)
Facilities and sources of oxygen supply						
• Oxygen cylinder	100.0% (9)	100.0% (2)	100.0% (2)	100.0% (1)	100.0% (1)	100.0% (15)
• Oxygen concentrator	88.9% (8)	100.0% (2)	100.0% (2)	100.0% (1)	100.0% (1)	93.3% (14)
• Manifold room	22.2% (2)	0.0% (0)	50.0% (1)	100.0% (1)	100.0% (1)	33.3% (5)
• Oxygen plant	11.1% (1)	50.0% (1)	0.0% (0)	0.0% (0)	0.0% (0)	13.3% (2)
Average number of O_2 concentrators available at SNCUs	7.5	5.0	7.5	11.0	7.0	7.4
SNCUs where staff trained for using oxygen plant setup[a]	100.0% (1)	100.0% (1)	-	-	-	100.0% (2)
SNCUs with oxygen plants having backup cylinder supply	100.0% (1)	100.0% (1)	-	-	-	100.0% (2)
SNCUs with a committee for managing oxygen supply systems	11.1% (1)	100.0% (2)	100.0% (2)	100.0% (1)	100.0% (1)	46.7% (7)
SNCUs that ran out of oxygen supply for a period in the past year	33.3% (3)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	20.0% (3)

[a]Out of SNCUs with the availability of oxygen plant system. SNCU: Special newborn care unit, RDS: Respiratory distress syndrome, CPAP: Continuous positive airway pressure.

Table 3: Practices related to oxygen therapy and its monitoring at SNCUs in Aspirational District [Numerators in parenthesis].

Parameters	State wise findings					Total
	Jharkhand	Uttarakhand	Punjab	Haryana	Himachal Pradesh	
Number of SNCUs assessed (N)	9	2	2	1	1	15
Method used for oxygen delivery						
SNCUs with functional flow meter/regulator for each O_2 dispensing outlet	100.0% (8)	100.0% (2)	100.0% (2)	100.0% (1)	100.0% (1)	93.3% (14)
SNCUs with multipara monitors available for 20% of beds	50.0% (4)	100.0% (2)	100.0% (2)	100.0% (1)	100.0% (1)	71.4% (10)
SNCUs with Nasal Prongs – Neonatal	77.8% (7)	100.0% (2)	100.0% (2)	100.0% (1)	100.0% (1)	86.7% (13)
SNCUs with Nasal Prongs – Pediatric	33.3% (3)	100.0% (2)	50.0% (1)	100.0% (1)	100.0% (1)	53.3% (8)
SNCUs with Nasal Catheter	100.0% (9)	50.0% (1)	50.0% (1)	0.0% (0)	0.0% (0)	73.3% (11)
SNCUs with head box	100.0% (9)	100.0% (2)	50.0% (1)	100.0% (1)	100.0% (1)	93.3% (14)
SNCUs with humidifier	100.0% (9)	100.0% (2)	100.0% (2)	100.0% (1)	100.0% (1)	100.0% (15)
Monitoring of oxygen therapy						
SNCUs where oxygen therapy is monitored based on						
• Both clinical signs and reading of Pulse oximeter	88.9% (8)	100.0% (2)	100.0% (2)	100.0% (1)	100.0% (1)	93.3% (14)
• Only reading of Pulse Oximeter	11.1% (1)	100.0% (2)	0.0% (0)	0.0% (0)	0.0% (0)	20.0% (3)
Frequency of monitoring and recording of oxygen therapy						
• 3 hourly or less	55.5% (5)	100.0% (2)	50.0% (1)	100.0% (1)	100.0% (1)	66.7% (10)
• More than 3 hours	44.5% (4)	0.0% (0)	50.0% (1)	0.0% (0)	0.0% (0)	33.3% (5)
SNCU following the practice of screening ROP	11.1% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	6.7% (1)

SNCU: Special newborn care unit, ROP: Retinopathy of prematurity.

Statistical Analysis

The information gathered from observations and interviews was compiled in Microsoft Excel (Office 365) for analysis. The results are presented as frequencies and proportions, both separately for each of the five states and in aggregate for all states combined.

RESULTS

Staff at all 15 functional SNCUs included in the study confirmed admitting newborns with respiratory distress and children under five years diagnosed with pneumonia. Eighty-seven percent of SNCUs provided oxygen therapy to children with respiratory conditions in the past three months, and 80% reported deaths of neonates and children due to respiratory conditions during the same period. The findings revealed from the comprehensive assessment are categorized and presented below.

Availability of Human Resource and Infrastructure

Forty-seven percent of SNCUs adhered to the guideline of having 4 doctors, while about 20% met the requirement of having 12 staff nurses, as stipulated in the national FBNC guidelines. One SNCU managed to fulfill both criteria for doctors and nurses. Bed availability varied, ranging from 6 to 20 beds per unit, with 80% of units having a recommended number of 12 pediatric beds. Emergency power backup to ensure continuous care during power outages or emergencies was available in 80% of units [Table 1].

Readiness for Diagnosing and Managing RDS

All SNCUs (100%) were equipped with pulse oximeters essential for monitoring blood oxygen saturation levels. Seventy-three percent of SNCUs were using monitor-based fixed pulse oximeters, while 60% and 13% of units used finger clip oximeters and handheld multimodal devices, respectively. X-ray facility was available in 87% of SNCUs, with 20% having bedside setups and 67% having non-bedside arrangements. CPAP devices were only available in 20% of SNCUs, limited to one unit in Jharkhand and two units in Punjab, with none in Uttarakhand, Haryana, and Himachal Pradesh. Moreover, the CPAP devices available at SNCU in Punjab were not operational due to staff lacking formal training. In Jharkhand, where CPAP was used, inadequate monitoring and record-keeping were noted due to the limited number and capacity of the nursing staff. Caffeine, a crucial drug for RDS management, was available in 33% of SNCUs in Jharkhand [Table 2].

Availability and Sources of Oxygen Supply

Overall oxygen availability at SNCU beds was 89%, varying across different units. Oxygen cylinders were available in all SNCUs, with B-type cylinders at 93% and D-type cylinders at 33% of units. Different sources of oxygen supply at SNCUs included oxygen concentrators (93%), manifold rooms (33%), and oxygen plants (13%). The SNCUs having oxygen plants had trained staff to manage incidents of central supply disruptions. Nearly half of the units (47%) had dedicated committees overseeing oxygen supply management. In-house maintenance teams were available in 27% of units, while others relied on external providers as needed. Twenty percent of SNCUs (3 units in Jharkhand) experienced oxygen shortages in the preceding year. Seventy-three percent of units had dedicated oxygen cylinder stands in every ambulance available at the facilities, but only 7% had oxygen-equipped stretchers in each ward for patient transfers.

Availability of Peripheral Equipment

Humidifiers were available in all 15 SNCUs, along with flow meters for oxygen cylinders. Forty percent of SNCUs reported using distilled water, and 27% used clean and sterile water for cleaning the humidifiers. Multipara monitors were available for 20% of beds in 71% of SNCUs. Neonatal and pediatric nasal prongs were available in 87% and 53% of units, respectively, while nasal catheters were present in 73% of units and head boxes in 93% of units [Table 3].

Practices Related to Oxygen Therapy and its Monitoring

Two-thirds of SNCUs used oxygen concentrators (67%) for administering supplemental oxygen, followed by central oxygen supply via manifold room or oxygen plant (26.7%) and oxygen cylinders (6.7%). The staff in all units had received training on operating oxygen concentrators, and 29% of units had staff with knowledge about proper disinfection procedures. Despite the widespread use of oxygen concentrators, 21% of units were equipped with analyzers to monitor oxygen production.

At 93% of SNCUs, oxygen therapy in hypoxic newborns was monitored based on clinical signs and pulse oximeter readings, with the remaining 7% relying only on pulse oximeter readings. In 67% of units, oxygenation status was monitored every 3 hours or more frequently throughout the day and night.

One SNCU in Jharkhand had an in-house facility for screening Retinopathy of Prematurity (ROP); other units referred newborns to specialized institutions or medical college hospitals for screening. None of the SNCUs recorded complications or fatalities due to RDS.

DISCUSSION

Every small and sick newborn deserves evidence-based and quality facility-based care. SNCUs are strategically located near labor rooms to provide specialized care (excluding assisted ventilation and major surgery) for sick newborns. Therefore, the role of SNCUs and their preparedness to manage respiratory distress are crucial requirements to improve birth outcomes, particularly in resource-constrained settings.

The study highlighted significant gaps in the availability of trained human resources within SNCUs. The national FBNC guidelines recommend a staff availability of 4 medical officers and 12 staff nurses at every SNCU. However, only 47% and 20.0% of SNCUs met the recommended requirements for medical officers and nurses, respectively. Infrastructural deficiencies were also seen, with 20% of units having less than 12 recommended beds and 11% lacking provision for oxygen supply. This finding aligns with previous studies indicating ongoing HR and infrastructure-related challenges at SNCUs.[14, 17, 18] Resource shortages at SNCUs can strain the overall health system, leading to a heavy workload for existing staff and affecting the timely provision of care.

In the global context, the use of CPAP with oxygen is a recommended practice to provide non-invasive clinical support to newborns with RDS and other respiratory conditions in newborn care facilities. This study revealed a notable disparity, with only 20% of units being equipped with CPAP devices. Conversely, another study indicated a higher level of CPAP utilization at SNCUs, with 36.6% of SNCUs in district hospitals and 68.3% in medical college hospitals employing CPAP for neonates.[14] This difference in CPAP usage in SNCUs at district hospitals can be attributed to the geographical scope of this study, which specifically focused

on the higher-priority Aspirational Districts, compared to another study, which included a mix of SNCUs from high-priority and non-high-priority districts. These districts, marked by suboptimal health and development metrics, epitomize the challenges prevalent across the broader healthcare landscape. Hence, our findings hold practical significance for guiding targeted interventions to improve service delivery within SNCUs, especially in the underserved and vulnerable geographies.

Diagnostic tools, including pulse oximeters for blood gas analysis, chest radiography, and clinical observations, are important for early diagnosis of RDS in newborns. Additionally, continuous monitoring of oxygenation status is crucial for early detection of complications. Our study revealed near universal availability of pulse oximeters in SNCUs, with 73.3% equipped with fixed monitor-based devices. However, bedside X-ray facilities for prompt diagnosis were limited, present in only 20% of SNCUs, despite an 86.7% overall availability. The oxygen supply was generally adequate, with all SNCUs having oxygen cylinders and 93.3% having oxygen concentrators. Published literature on diagnostic facilities and oxygen supply availability in SNCUs in India is sparse. A study in Uttar Pradesh found low pulse oximeter availability and functionality, with only 2 out of 4 SNCUs having the devices, with only 73% functionality.[19] Another study highlighted a 16.7% deficit in mobile X-ray unit availability, indicating a gap in meeting SNCU guidelines.[20]

RDS stands as a predominant cause of neonatal mortality in India. Therefore, ensuring the availability of CPAP facilities with oxygen supply at these government units, where most sick newborns are treated, is paramount. The results of this study emphasize the critical need to improve the accessibility and utilization of CPAP devices and enhance the effectiveness of oxygen delivery systems in line with global recommendations for managing newborn RDS in newborn care units at secondary public healthcare facilities. With facility-based births rising globally, reaching nearly 80% and accounting for 88.6% in India, strategically placing CPAP facilities at SNCUs could significantly improve newborn health outcomes.[21]

Secondly, there is a significant evidence gap regarding the feasibility and effectiveness of CPAP usage in newborn care units, especially in resource-constrained settings like Aspirational Districts. This underscores the necessity to demonstrate and validate the operational feasibility of an innovative, evidence-based implementation model that ensures the availability and optimal use of CPAP devices and ensures health system readiness to manage RDS among sick newborns in public health settings of vulnerable geographies.

Integrating capacity-building of SNCU staff on oxygen therapy and complication monitoring, fostering collaboration among healthcare stakeholders, and implementing standardized protocols are pivotal for sustainability and enhancing care quality and outcomes for newborns. Moreover, collaboration among government agencies, healthcare providers, and international partners is essential for implementing evidence-based interventions to reduce neonatal mortality and improve care quality for sick newborns in vulnerable geographies of the country.

Strengths and Limitations of the Study

The main strength of this study is that it represents a pioneering effort in assessing the functioning of oxygen supply systems and the availability and utilization of CPAP availability in SNCUs located in government secondary hospitals of high-priority Aspirational Districts across five states of India. It sheds light on critical gaps and strengths in the system's readiness to manage newborn RDS. Nonetheless, several limitations should be acknowledged. Firstly, the study focused exclusively on SNCUs situated in government hospitals within Aspirational Districts, thereby potentially limiting the generalizability of the findings to SNCU facilities in non-aspirational districts or those located in other states. Secondly, due to ongoing restrictions related to the COVID-19 pandemic, direct observation and validation of some of the practices was a challenge. Lastly, the study's scope was restricted to government health facilities, excluding newborn care units located in private hospitals, which cater to a significant proportion of sick neonates, particularly in urban areas. This omission may overlook important insights into the availability and utilization of oxygen supply systems and CPAP devices in the private healthcare sector, thereby limiting the comprehensiveness of the study's findings.

CONCLUSION AND GLOBAL HEALTH IMPLICATIONS

Recognizing the critical role of CPAP and oxygen support in managing RDS and improving newborn survival, a significant gap persists in understanding the accessibility and functionality of these interventions in newborn care units across Aspirational Districts in India. While most SNCUs demonstrated readiness in basic infrastructure and oxygen supply, notable disparities were identified, particularly concerning CPAP availability, functionality, and the lack of standardized protocols. The findings of this study offer critical insights for evidence-based policymaking, targeted interventions, and effective resource allocation, especially in vulnerable geographies.

Key Messages

1. The study reveals a substantial deficit in the availability of continuous positive airway pressure (CPAP) devices across

Special Newborn Care Units in high-priority Aspirational Districts in India. 2. Despite the availability of CPAP devices at certain places, issues such as non-operational equipment and lack of formal training for staff were prevalent. 3. The study highlights the broader challenges within the healthcare system, emphasizing the urgent need for targeted interventions to improve the effectiveness of oxygen delivery systems and the availability of CPAP devices, particularly in resource-constrained settings.

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COMPLIANCE WITH ETHICAL STANDARDS

Conflicts of Interest: All the authors declare no conflict of interest. **Financial Disclosure:** Nothing to declare. **Funding/Support:** This work was made possible by the support of the American people through the United States Agency for International Development under the terms of Cooperative Agreement Number 72038621CA00004. **Ethics Approval:** Administrative authorization was received from the State Health Missions of five respective states before conducting the assessment. **Declaration of Patient Consent:** Patient's consent is not required, as the patient's identity is not disclosed or compromised. **Use of Artificial Intelligence (AI) Assisted Technology for Manuscript Preparation:** The authors confirm that there was no use of AI-Assisted Technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI. **Disclaimer:** This paper's contents represent the author's views and do not reflect those of the USAID or the United States Government.

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